tion fatigue must be due to differences in the conducting portion of the fibers, rather than in any difference in their sheaths.

Several other points of interest may be abbreviated from the conclusions as follows: 1. Cooling may be conveniently used to block the nerve impulse where it is desirable to suspend conductivity without injury to the nerve. 2. The temperature at which conductivity is suspended varies somewhat in different fibers, lying between 5 and 0 C. The cardiac inhibitory fibers of the rabbit offer an exception to both of the above rules in not regaining conductivity well and in losing it at 15 C. 3. "A nerve impulse in passing into a stretch of fiber of different temperature may suffer an increase or a diminution in force, according as the temperature of this portion of the nerve is above or below that in which the impulse originated." The force of the impulse is increased by heat and diminished by cold. 4. The method of cooling may be used to differentiate the physiological varieties of nerve fibers combined in a common trunk, viz., to separate vaso-constrictors from vaso-dilators in the same trunk, inhibitory and augmentory fibers in the vagus, etc.

A Microscopical Study of Changes Due to Functional Activity in Nerve Cells. C. F. HODGE. Journal of Morphology. Vol. VII. pp. 95-168. Plates VII. and VIII. 1892.

The earlier experiments in this research were first reported in this JOURNAL for 1888, '89 and '91, and dealt respectively with the changes produced in spinal ganglion cells by electrical stimulation and with the process of recovery from fatigue thus produced. It is unnecessary to recapitulate the results of these experiments further than to remind the reader that the nucleus became smaller, irregular in outline and stained darker as stimulation was continued, and the cell protoplasm became more or less vacuolated according to the degree of fatigue induced.

The point in which the present paper forms an advance is in a study by similar methods of effects in the nerve cells of normal daily activity, and it is intended in this review to cover this last section of the work.

The experiments were made by taking the animals, English sparrow, pigeon, swallow and honey bee, at the beginning and end of their day's work. The above animals were chosen because of their constant and well defined rhythm of diurnal activity. Similar preparations of the cerebrum, cerebellum and spinal ganglia were compared in six pairs, morning and night, of birds, and the cerebral ganglia of ten couples of bees each morning and night. The result, which is of greatest interest to psychologists, is that a greater degree of fatigue-change is often produced by ordinary daily work than can be obtained by electrical stimulation. Sets of cells were measured as in the former experiments, and the nuclei were found in all cases smaller in the evening specimens. This difference in the spinal ganglion cells of the birds amounted to from thirty-three to sixty-four per cent., showing an average for the birds of forty-eight and two-tenths per cent. The nuclei of the cells of the occipital cortex showed a slightly greater difference, thirty-six to sixty-nine and seven-tenths per cent., with an average loss of fifty-one and five-tenths per cent. In the honey bee experiments, the nuclei of the antennary lobes were measured and showed a shrinkage in volume of from nine to seventy-five per cent. The spinal ganglia of two foxes were also examined and only a moderate degree of change was demonstrated. As the carcasses after skinning could not be identified, the amount of fatigue, or the length of

chase, could not be determined. In the motor cells of the spinal cord of a patient dying of hydrophobia, the nuclei were found to be much shrunken, being nine per cent. smaller than corresponding nuclei in a so-called normal human cord. It is not strange that we should find a greater amount of change in daily fatigue than in artificial stimulation. It is not possible to obtain secretion of a gland or contraction of a muscle by application of electrical stimuli equal to that produced by the normal nerve impulse to gland or muscle. Two plates containing thirteen figures give the entire research at a glance.

The Formation of the Medullary Groove and Some Other Features of Embryonic Development in the Elasmobranchs. WILLIAM A. LOCY. Jour. Morph., Vol. VIII. 1893.

The Optic Vesicles of Elasmobranchs and their Serial Relation to Other Structures on the Cephalic Plate. Ibid., Vol. IX., pp. 115-122. 1894.

Metameric Segmentation in the Medullary Folds and Embryonic Rim. (Prelim. Comm.) Anatomischer Anzeiger, IX., pp. 393-415. 1894.

Locy states at the close of the last paper that he is not ready, as yet, to generalize upon the segmentation of the vertebrate nervous system. However, the facts which he brings together point strongly toward a helpful generalization in the near future. It has come to be quite generally held by morphologists that it is the mesoblast which becomes segmented primarily, and that segmentation of the neural tube is moulded by these bone and muscle somites and accommodates itself to them. Contrary to this view, in embryonic stages much too young to show any trace of mesoblastic somites, Locy finds a perfectly regular, symmetrical and constant segmentation of the neural plate. He has succeeded, in one of the sharks, in tracing out this segmentation in a consecutive and orderly way, and has also succeeded in demonstrating it in early embryos of Amblystoma, Diemyctylus and Torpedo Ocellata. In all Locy finds eleven metameres in the expanded portion of the neural plate which represents the brain. These are distributed to the three primitive cerebral vesicles as follows: six for the third vesicle, two for the second, and three for the first. Later all traces of this segmentation become masked by the development of special structures throughout this entire region. The fact of such a segmentation appearing so early should be given prominence in working out the ancestry of vertebrates. At first all the metameres are alike, which would indicate an ancestral form of this character, *i. e.*, without differentiation in the neural tube. As cephalization advances, differentiation takes place, and it is in this that the primitive segmentation is lost.

This brings us to the first pages of our author. The first structures to make their appearance in the segmented neural plate are the pits which represent the optic vesicles. Just behind these appear a second pair of depressions, the so-called accessory optic vesicles, which give rise later to the pineal gland. Still a third pair of pits may be observed behind the second, but these early become obscured. This series of depressions is taken to represent a multiple eyed condition, common enough in invertebrates, but not known in any vertebrate, and this, too, is of significance in a search after the ancestral form. The arrangement of these optic vesicles in a laterally symmetrical series inclines the author to the view that the eye may be homologized with the sense organs which spring from the lateral line.